RANGE IMPROVEMENT NOTES

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INTERMOUNTAIN REGION — OGDEN, UTAH

STATEMENT OF PURPOSE

This publication is printed primarily to inform professional range administrators of important range improvement and management developments and findings. These "Notes" may include extracts of published papers, unpublished preliminary reports of research work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

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SOME OBSERVATIONS ON PINYON-JUNIPER DENSITY WITHIN A STUDY PLOT IN EAST CENTRAL ARIZONA

by
Carl-Eric Granfelt*

Pinyon-juniper control for forage and water yield improvement is gaining increasing attention in the intermountain and southwestern regions of the United States. With this increased emphasis, information regarding pinyon-juniper populations will of necessity become a concern to those involved in such programs. This paper reports some observations concerning the pinyon-juniper density on a study plot located on the Fort Apache Indian Reservation which is located in east central Arizona.

In 1929 a range study plot designated as A2 was established on the R-14 range unit (now Range Unit No. 3, Cedar Creek Livestock Association) to observe the effects of livestock exclusion on native forage species. This area is at an elevation of approximately 5,200 feet, receives between 17 and 19 inches precipitation annually, and is characterized by undulating slopes of alluvium on Supai formations. Slopes range from 3 to 12 percent. Soils are gravelly loams to clay loams. The vegetation on the area was characterized by groves of trees and shrubs with a grass understory occupying the gravelly hillocks, with beargrass, yucca and occasional juniper trees found on the lower slopes and leveler portions of the area.[1] It is felt that the pinyon-juniper density had increased on this site since the advent of grazing and control of fires which has occurred since the beginning of this century.

The plot is two hundred feet on a side and is subdivided into 100 equal subplots. All tree, shrub, and halfshrub species found within the plot were charted in 1929 and again in 1938. A fence excluded livestock from this plot from 1929 until sometime during 1945. In 1957 a juniper control program in this area resulted in the removal of all prominent pinyon, juniper, and oak trees located within the plot. This control program employed both cabling and hand chopping to reduce the pinyon-juniper population on the area. In 1963, this plot was re-established from five of the 1938 subplot corners which still remain on the area. All live tree, shrub, and halfshrub species were again charted. This article, however, will deal only with the pinyon-juniper portion of the population.

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[1] A list of the most common species found on each site is presented at the end of this article.

Table 1. PINYON-JUNIPER POPULATION ON RANGE PLOT A2

	Total Number of Plants			Number of Subplots With Plant		
	1929	1938	1963	1929	1938	1963
Pinyon	18	27	1	9	15	1
Juniper	46	51	71	30	33	38

Improved herbage conditions, as well as the removal of the physical threat to the plant resulted from the exclusion of grazing animals, and undoubtedly, accounted for the increase in pinyon pine during the period 1929-38. The single pinyon pine found in 1963 was a survivor of the pretreatment population. No pinyon pine seedlings were found on the area in 1963.

The 1963 juniper population which was much greater than that of either 1929 or 1938 appears rather disquieting in that it represents a post treatment population. Unfortunately, no chart was made of the plot before or following the 1957 treatment. Therefore, it is impossible to positively state the number of trees that survived the treatment compared to those which germinated and became established following the treatment. The 38 subplots with juniper in 1963 included 15 new subplot occurrences. Although the juniper biomas in 1963 was much less than that existing prior to the treatment in 1957, it also represents a population that, without further control, could equal or even surpass the pretreatment level.

In order to estimate the post treatment population the 1929, 1938, and 1963 data were compared.

Table 2. JUNIPER RELATIVE AGE CLASS BREAKDOWN

Total juniper on plot in 1963	71
Alligator juniper sprouts; represent "1929 chart" trees	-3
Lower branches of trees cut in 1957; represent "1929 chart" trees	-2
Possible seedlings charted in 1938	-3
Total juniper considered as post "1938 chart" trees	63

Table 3. LOCATION OF JUNIPER IN 1963 IN RELATION TO TREES PREVIOUSLY CHARTED (RADIUS AROUND BOLE)

Within 5 feet	Between 5 and 10 feet	Outside 10 feet
17	23	23

Table 4. HEIGHT OF JUNIPER IN PLOT

Less Than 6 inches	Between 7-12 in.	Between 13-24 in.	Between 25-36 in.	Greater Than 36 inches
13	37	6	6	1

The height and distribution of the 1963 juniper population indicates that between 45 and 50 of the present population are post 1957 seedlings, while about 13 to 18 of the trees were probably established after 1938, while 8 trees were likely present on the plot in 1938.

All pinyon pine and junipers were eliminated on this plot in April of 1964 by hand cutting. Observations in the future will provide information on the rate of recurrence of these species on this plot.

SUMMARY

The 1957 treatment appeared to have effectively eliminated the pinyon-juniper population on this study plot. However, after careful study of the plot in 1963, it was found that the juniper density was possibly greater than that existing before the treatment. Pinyon pine, however, was apparently effectively controlled by the treatment.

Post treatment followup programs appear necessary on pinyon-juniper areas to assure long term benefits from such practices. Assuming an adequate immediate followup on areas chained or cabled, the length of time from the initial treatment to the first maintenance treatment will naturally vary with the conditions existing. No matter how thorough the initial treatment, some plants will survive and germination of seed can be expected. The cabling or chaining itself will have a beneficial effect on seeding establishment, through spreading seed, preparing somewhat of a seedbed and generally removing or reducing competition. On the A2 plot, a fire would have probably reduced the 1963 juniper population by approximately 75 percent. However, a fire would also have presented some management problems. Hand clearing, such as was carried out in 1964, is considered as being the most effective method of maintenance on this area. Actually with the conditions present in 1964, it is felt that it would be best to plan the first maintenance program on areas such as this, 10 to 15 years following the initial treatment. This should allow most juniper seedlings to attain 12 inches or more in height and thus be more evident. This in turn should assure a high followup kill and reduce the time per tree in hand cutting or spraying operations.

A pinyon-juniper density tolerance level and size distribution should be established for various sites. Such guides would aid in determining when maintenance programs should be initiated.

MAJOR SPECIES ON PLOT A2

Gravel hillocks, tops and upper slopes (3-12 percent slopes)

Pinyon Pine	Pinus edulis Engelm.
Juniper*	
Oak**	
Skunkbrush	Rhus trilobata Nutt.
Beargrass	Nolina microcarpa Wats.
Sideoats Grama	Bouteloua curtipendula (Michx.) Torr.
Blue Grama	B. gracilis (H. B. K.) Lag.
Ring Muhly	Muhlenbergia torreyi (Kunth) Hitchc. ex Bush.

Lower slopes (3-8 percent slopes)

Juniper	
Beargrass	
Yucca	Yucca spp.
Blue Grama	
Sideoats Grama	
Hairy Grama	B. hirsuta Lag.
Black Grama	B. eriopoda (Torr.) Torr.
Three Awns	Aristida spp.
Stipa	Stipa neomexicana (Thurb.) Scribn.

Level areas (3 percent slope)

Blue Grama
Western wheatgrass Agropyron smithii Rydb.

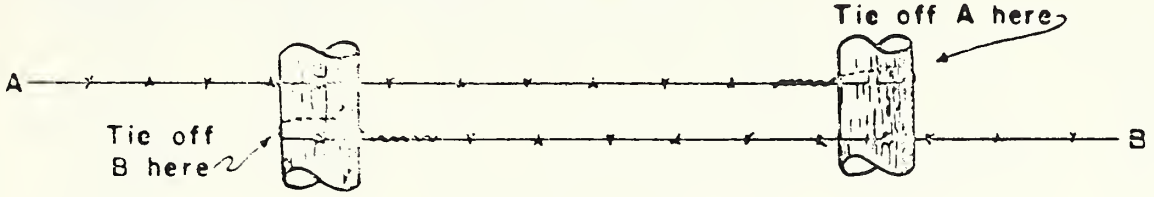
* Three of the juniper were definitely Juniperus depeana Steud., however, identification of the rest is questionable. The 1929 and 1938 notes identify them as being J. monosperma (Engelm.) Sarg. In 1963 only seedlings, small trees and the 3 alligator sprouts were found on the plot. However, from examination of juniper in this general area, it is my belief that most, if not all, of the juniper may have been J. osteosperma (Torr.) Little. This juniper identification in itself is often a problem.

** Oaks - Some Quercus turbinella Green, some may be Q. grisea Liebm. and some hybrids.

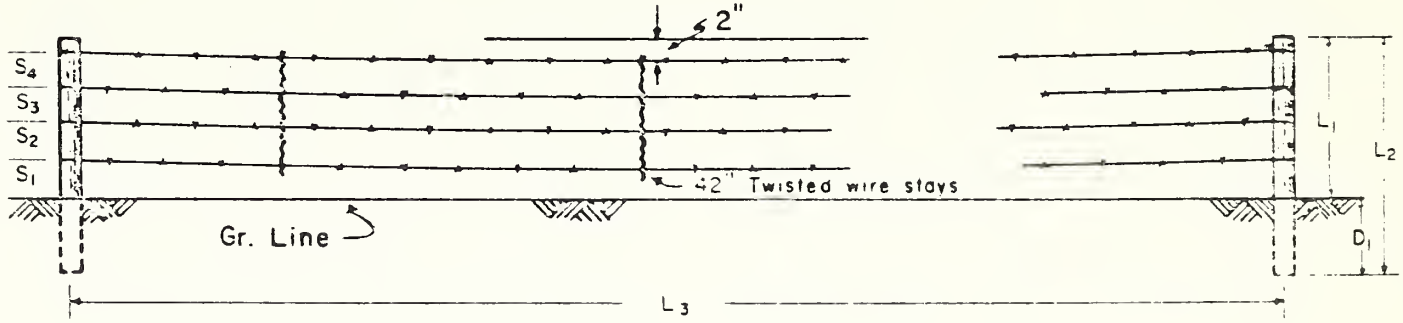
Bureau of Land Management Suspension Fence

Suspension fences built in the Ely, Nevada, area have so far proven very satisfactory. Built in 1963, there has been no maintenance work needed. The cost of this type of fence has been about $450 to $500 per mile. The Ely District personnel of the U.S. Forest Service consider the fence to be very satisfactory on flat or rolling country, but do not believe it is a practical fence in rough, steep country. (See fence specifications on next page.)

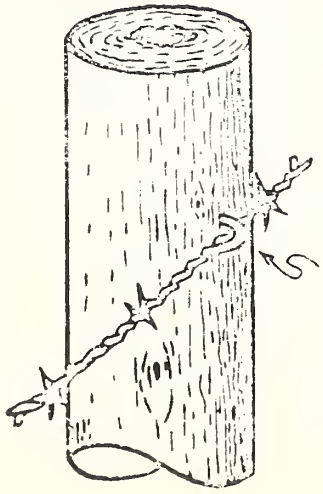
Do not splice at stretch panels — tie off all wires by cross tying at each stretch panel. (See below)



General: The suspension-type fence is hung in 1/4 mile sections, rather than from post to post. For this reason care must be taken to firmly plant all line, brace, and stretch panel posts. The wire must be allowed to slip through the staples freely, thus allowing the natural "give" of the fence to stretch and bounce back with pressure.



STAPLE DETAIL



1"x4" Steel telephone staples

Leave 3/4" out of post to allow wire to slip through.

Allow 2" sag from horizontal between line posts to adjust to temperature variations. Install 42" twisted wire stay at approximately 16'-6" between line posts.

S_1	18"	L_1	4 FT
S_2	10"	L_2	7 FT
S_3	10"	L_3	100 FT
S_4	12"	D_1	3 FT

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
IDAHO STATE OFFICE

TYPICAL SUSPENSION-TYPE FENCE

DRAWN BY [illegible]	CHECKED BY
DESIGNED BY	
DIST. OFFICE	DRAWING NO. IDE-7
DATE 12-64	SHEET NO. 1 OF 1

Abstract from an article entitled
CHEATGRASS (Bromus tectorum L.)
which appeared in the April-June 1964
issue of the BOTANICAL REVIEW
by
James O. Klemmedson and Justin G. Smith*

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OPPORTUNITY FOR CONTROL
By Burning

There is considerable difference of opinion about the effectiveness of fire as a tool for reducing cheatgrass stands. Studies in southern Idaho showed that during the year following burning, cheatgrass plants are far fewer than on unburned ranges. Counts at several locations showed an average of one-fifteenth as many plants on burned as on unburned ranges.

Time of burning is evidently an important factor determining subsequent stand density. Areas burned in early summer had light remnant stands compared with fall-burned areas. Studies near Boise, Idaho, showed that June and July burns reduced plant numbers to 14 and 11 per square foot compared to 41, 45, and 124 plants per square foot, respectively, on August, October, and November burns. A reduction in early spring forage production accompanied the low number of plants on burned-over cheatgrass ranges. During the first 20 days of the growing season, height growth of plants on the burned areas was only half of that on unburned areas; but plants on the burned area were taller at maturity. On the other hand, most of the authors point out that, although cheatgrass stands may sometimes be reduced enough by summer burning to allow successful seeding of crested wheatgrass and other perennial species in the fall, this reduction is not consistent from year to year. Stark et al. reported that cheatgrass was effectively controlled by burning in late spring just as the seed matured, but before it shattered. Plummer et al. experienced similar results.

Warg in disagreement with many other observers, felt that burning was not a satisfactory means of controlling cheatgrass. Leopold agreed, stating, "The more you burn cheatgrass the thicker it grows next year, for the seeds shatter early and harbor in cracks in the ground."

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*Intermountain Forest and Range Experiment Station, Boise, Idaho; and Pacific Northwest Forest and Range Experiment Station, LaGrande, Oregon, respectively. Forest Service, U.S. Department of Agriculture

The latter part of Leopold's statement is significant and has been stressed by others as a key to the success of cheatgrass in competing with perennials. Tisdale found that burning after the seed had matured has little effect on subsequent stands because much of the seed drops to the ground and thereby escapes injury. Billings stated:

> Since by the time of the fire, the seeds of Bromus are on the ground while the seeds of the perennial herbs and shrubs are still attached to the plants, the survival of Bromus seed during the fire is far higher than that of most perennial species. The result, within a year or two after the fire, is extensive stands of annual Bromus marking the fire scar and providing ready tinder for additional fires.

Fleming et al. similarly explained the ability of cheatgrass to come back after burns. They concluded that, since the burned areas are quickly reoccupied by cheatgrass, the seeds of cheatgrass are apparently not severely injured by fire. Warg ascertained from his studies that cheatgrass is damaged less by heat than native perennials are.

From laboratory studies, Sampson reported that five-minute exposure to temperatures of 250° to 300° F. kills most dry seeds. His tests included Bromus mollis and B. rigidus, both of which were killed at 260° F. Bentley and Fenner studied burning conditions in annual grass litter and reported that where the prefire litter was thin, temperatures at the mineral soil surface were typically in the 200° to 250° interval. At one out of 14 stations the temperature was higher than 250° F. Assuming that temperatures of 250° to 300° F. are required to kill most seed under field conditions, as Sampson observed, Bentley and Fenner concluded, "A grass fire would have little effect on the survival of seed located at the mineral soil line or in the mineral soil." The duration of maximum soil temperatures during burning of grass was considerably less than five minutes. Grass fires produce the highest temperatures (up to 450° F.) in the litter cover above the soil. "A fire soon after maturity and drying of grass, before seed has shattered or while it is still on top of the litter, would have the greatest effect in reducing stands of annual grasses."

Fire apparently gives another competitive advantage to cheatgrass. Many perennial grasses and forbs are either destroyed or badly damaged by the intense heat that sometimes occurs in range fires. Injury to perennial grasses and forbs may leave considerable unoccupied area for invasion of cheatgrass. Once an area is occupied by cheatgrass further burning offers an opportunity for annual weeds to gain a foothold.

By Cultivation and Seeding

It is now well established that cheatgrass can be most easily controlled by seeding to adapted perennial grasses. . The literature contains considerable general information on how to control cheatgrass prepartory to reseeding. However, the details applicable to any particular situation are not readily available. This review has pointed out that various characteristics enable cheatgrass to compete successfully with the more desirable perennial species. Reseeding investigations have confirmed, as shown by observations, that results of seeding perennial grasses into cheatgrass without seedbed preparation are erratic and most often end in failure.

Poa bulbosa is the only species mentioned in the literature that has been successfully seeded in cheatgrass stands on western rangelands without first reducing the cheatgrass. In addition to establishing itself successfully in cheatgrass stands, Poa bulbosa has also been observed to extend its occupation at the expense of the remaining cheatgrass.

Under semiarid conditions, dense stands of cheatgrass draw heavily on available soil moisture during growth. After cheatgrass matures, moisture is often inadequate to sustain slower growing perennial grass seedlings through the normally dry summer and fall.

From observation and experimental evidence, Robertson and Pearse concluded that well-established stands of B. tectorum and Artemisia tridentata in the Intermountain Region are essentially closed to mass invasion. In their studies, only one species, Agropyron cristatum, made satisfactory stands, and reduction of competition clearly contributed to its success. The average rating (on a scale of 1 to 10) of four-year-old stands of A. cristatum in the closed community was 3.6 compared with 9 4 in open community.

In controlled greenhouse experiments, Evans has recently demonstrated that B. tectorum at 64 and 256 plants per square foot severely curtailed shoot and root growth and greatly increased mortality of A. desertorum. At densities of four and 16 cheatgrass plants per square foot, growth and survival of A. desertourm were moderately reduced. Shading of A. desertorum was important in the early stage of competition, but depletion of soil moisture by the cheatgrass was the effective factor in later stages of competition.

From numerous comprehensive studies, Hull and Stewart evaluated several methods of cheatgrass removal and seeding. Table II is reproduced from their paper and illustrates the merits of each method.

Table II

COMPARISON OF METHODS OF CHEATGRASS REMOVAL & SEEDING

Method of killing cheatgrass	Optimum date of treatment	Expected cheatgrass kill (percent)	Expected stand of reseeded grass	Relative cost of thinning & seeding
Moldboard plow	Any season	95 to 98	Poor to good	Very high
Wheatland-type plow or heavy disk	Spring or late fall	80 to 98	Fair to good	High
Light disk or shallow cultivation	Spring or late fall	40 to 75	Poor to good	Medium
Spring-tooth harrow	Spring or late fall	30 to 70	Very poor to fair	Medium
Spike-tooth harrow	Late fall	5 to 30	Very poor to poor	Low
Deep-furrow Lister drilling	Late fall	50 to 85	Fair to excellent	Medium
Planned burning	Early summer	75 to 95	Fair to excellent	Low
Drilling	Fall	5 to 30	Very poor	Very low

The most effective method of eliminating cheatgrass competition is plowing with a moldboard plow. By this method, the seed is completely buried beyond germination depth. Summer fallowing by moldboard plowing has been practiced on many thousands of acres in Washington and Oregon, and the results are normally very good. However, moldboard plowing is very expensive and is not always feasible.

Other methods reported by Hull and Stewart and shown in Table II have been described elsewhere with similar findings.

By Use of Chemicals

Control of cheatgrass by chemicals has received considerable attention in recent years. Chemicals appear to be justified for controlling cheatgrass in fields used for seed production of perennial grasses, in firebreaks, in stopping spot invasion, in productive haylands, or in establishment of perennial grasses or browse plants on the range (Range Seeding Equipment Committee, 1959). Control with chemicals on extensive rangelands does not now appear feasible, and it is doubtful that chemical control without reseeding accomplishes more than a very temporary control.

Many chemicals have been found successful. CIPC (isopropyl N-(3-chlorophenyl) carbamate) has been effective when applied preemergently to prevent germination, IPC (isopropyl N. phenylcarbamate) and TCA (tricloroacetic acid) give control from preemergence or seedling applications, Dalapon (2,2-dichloropropionic acid), monuron (3-(p-chlorophenyl)-1, 1-dementhylurea) and disodium salt of endothol also have satisfactorily controlled cheatgrass.

The most satisfactory control of cheatgrass has been obtained when chemicals have been applied at the time of seeding emergence. This usually occurs in the fall if moisture is available for germination. However, successful application may range from preemergence to the second-leaf stage (Range Seeding Equipment Committee, 1959).

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You can save yourself

a lot of trouble

by

not borrowing any

--Everett Mitchell
"National Farm & Home Hour"

Abstract from an article entitled
"Extended Grazing of Crested Wheatgrass by Cattle"
from
UTAH FARM AND HOME SCIENCE, Vol. 26, No. 1 March 1965
by
Lorin E. Harris*, Neil C. Frischknecht**, and Earl M. Sudweeks***
"Application For Nevada" by
H. M. Kilpatrick#

AUTHOR'S CONCLUSIONS: Where there is no alternative for summer and fall grazing except on crested wheatgrass, cows can be maintained with supplement and still raise a calf which will sell well as a feeder.

Yearlings will make reasonable gains, show thriftiness, and be ready for replacements or finishing the following year. Yearlings did as well in the crested wheatgrass pastures as on the forest.

Yearlings made greater gains during the spring periods than did the cows and calves. As the season progressed, the yearlings continued to gain until the end of the early fall period (up to October 23); however, they lost slightly during the late fall period (Oct. 23-Nov. 26). There was no significant difference in gain of weight between the supplemented and non-supplemented yearlings.

Supplemented cows produced more gain per acre than nonsupplemented cows. If cows were fed the equivalent of 0.75 pound of supplement, or if calves were nursing cows fed a supplement from early summer to late summer, they did as well as cows or calves on the forest. In late summer and fall, cows ate the seedheads mainly on the dry grass on ridges and flats. The nutritive quality of seedheads are superior to that of dry stems.

The total gain of animal weight, from crested wheatgrass grazing, was greatest during the late spring grazing period when the gain per acre averaged approximately 35 pounds. As the grazing season progressed the gain per acre decreased.

APPLICATION FOR NEVADA: This research study is timely and directed to an area of need raised by County Agents and others at the last Max C. Fleischmann College of Agriculture Conference.

A rancher in White Pine County (because he had no forest permit) has worked with County Extension Agent A. Z. Joy to extend the grazing of crested wheatgrass by cattle for the past three grazing seasons with good success.

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**Range Conservationist, Intermountain Forest & Range Experiment Station
***Research Assistant, Utah State University
#Range and Pasture Specialist; Cooperative Extension, University of Nevada, Max C. Fleischman College of Agriculture

Further studies are needed to determine the effects and economics of providing creep feeders for calves. Perhaps if only calves were supplemented there would be no need to supplement the cows. Nonsupplemented cows in this Utah study had an accumulative gain on crested wheatgrass of about 95 pounds, which might be considered satisfactory.

Proper management of crested wheatgrass seedings is necessary if extended grazing is contemplated. Adequate watering facilities and pasture units are vital to successfully extend the grazing season.

We might also ask what effects shade structures might have on weight gains. Most crested wheatgrass pastures are lacking in shade facilities - perhaps because they have been primarily used only in spring and early fall when temperatures are not too high.

DETAILS OF STUDY: This study was a cooperative experiment between Utah State University and the Intermountain Forest and Range Experiment Station. The report covers a three-year period from 1961 through 1963. Grazing of the crested wheatgrass fields was conducted at the Benmore Experimental Area located in southeastern Tooele County, within a belt commonly considered as spring-fall range in the Intermountain Region. The elevation is approximately 5,800 feet and the average annual precipitation is about 12 inches.

The grass stands are now approximately 25 years old. At present crested wheatgrass including both fairway wheatgrass (Agropyron cristatum) and so-called "standard" crested wheatgrass (Agropyron desertorum) make up about 95 percent of the forage with minor amounts of western wheatgrass (A. smithii), bulbous bluegrass (Poa bulbosa) cheatgrass (Bromus tectorum) squirreltail grass (Sitanion hystrix), and several forbs.

Big sagebrush (Artemisia tridentata) and rabbitbrush (Chrysothamnus nauseous) are present in varying amounts, but were seldom eaten by cattle in the experimental pastures.

Cows with their calves and yearlings were grazed for six consecutive periods from about April 20 to December 15, excepting that the calves were sold in mid-October. The six periods were early and late spring, early and late summer, and early and late fall. The spring periods were approximately 30 days each and the summer and fall periods averaged about 40 days each.

Pastures that were grazed in the early spring were grazed again in the early fall since the short early-spring period allowed the grass to regrow and head out following grazing. There was usually no regrowth following the late spring treatments, since the cattle removal date usually coincided with the end of the spring growing period in late June.

Eighteen of the 100-acre pastures were divided into three blocks of seven pastures each. Pastures to be grazed in early spring, summer and fall were divided by an electric fence into two pastures of 50 acres each to facilitate the feeding of a protein supplement to half the animals. Four yearlings selected at random were placed in each 100-acre pasture and 2 yearlings in each 50-acre pasture. In addition, cows with a calf were allotted at random to all pastures in keeping with predetermined stocking rates; usually about five cows and calf pairs were allotted each yearling.

Some shifting of animals was necessary to achieve the desired grass use of 60 to 70 percent. All animals were weighed individually after an overnight shrink in the corral before being placed in, or taken out of the pasture.

Yearlings and lactating cows received the equivalent of 0.75 pound per day of protein supplement on Monday, Wednesday and Friday. The supplement had the following percentage composition; Soybean meal, solvent extracted 44 percent protein - 88.2%; Dicalcium phosphate - 10.8%; Trace mineral salt - 1.0%. This formulation provided 0.75 percent of the daily requirement of phosphorus if 0.75 pound of supplement was consumed. All animals received rock salt during the summer and fall periods, they received crushed salt in one side of a self feeder and one part trace mineral salt and one part dicalcium phosphate in the other half of the feeder.

Bulls were put in the pastures at the beginning of the late spring period. At the end of this period, part of the cattle were moved to the mountainous summer range on the forest south of the pastures.

The stocking level in early spring averaged about 5 acres per cow month. At this rate the cows ate the grass about as fast as it grew. By late spring, about May 21, the grass was sufficiently abundant that about twice the number of animals were grazed on the same acreage. The stocking level in early fall, on pastures that had been grazed in early spring, averaged about 5 acres per cow month making the total capacity for these pastures about equal to that of pastures in the other treatments. The only difference was that half the capacity was taken in early spring and the other half in early fall, rather than in one period.

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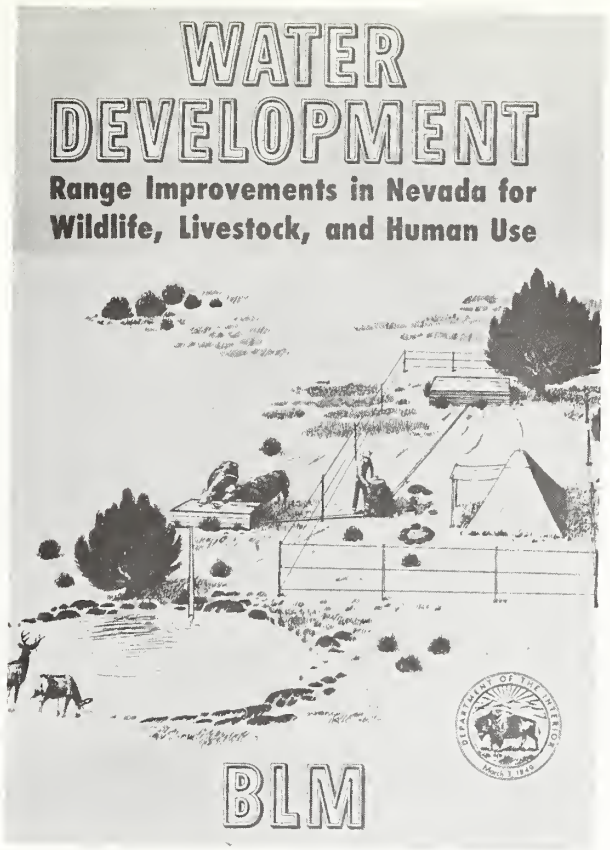
The best way out of a difficulty is through it.



Front cover of a new brochure released by the Nevada State Office of the Bureau of Land Management

Jim Yoakum, Wildlife Specialist, reports that the main purpose of this publication is to assemble ideas pertaining to water developments and to show how many of them can, with minor adjustments, be adapted for more than one use.

Editor's Note: The brochure contains excellent diagrammatic sketches of a number of types of water developments.